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Underwriters Laboratories Inc.®

October 31, 2001

Capstone Turbine Corp.
Chatsworth, CA

Attention : Mr. Bryan Fox

Fax No: 1-818-734-5467

Subject: UL 1741 Of 60KW ECM/LCM Model Inverter/Generator Combination

Reference: Project 01SC10272, E209370, AU2687

Dear Mr. Fox:

We have completed our subject evaluation under Project 01SC10272, E209370 for "Utility Interactive" requirements. Testing was conducted to The Standard For Inverters, Converters and Controller For Use In Independent Power Systems, UL 1741, First Edition. The above unit was evaluated to the following "Utility Interactive" requirements under the mentioned standard:

a. Harmonic Distortion
b. DC Injection Test
c. Utility Voltage and Frequency Variation
d. Anti-Islanding
e. Output Short Circuit Test

We have attached the test results for the above tests under attached Appendix.

If you have any questions, please feel free to contact the undersigned.

Regards,	Reviewed By:
ADALBERTO MARGARITO(Ext.32341)	IAN McDONALD(Ext.32802)
Project Engineer	Project Engineer
Conformity Assessment Services	Conformity Assessment Services
Section 3016JSCL	Section 3016JSCL

OUTPUT RATINGS/DC INJECTION TESTS:

METHOD

A sample of the ECM, BCM and LCM units were installed as intended in microturbine Model 60 KWSA. The outputs of the microturbine were connected to its rated simulated utility supply, and were adjusted to result in the rated output power as indicated.

During the test, the DC current injected into the utility and the starting inrush current was also measured.

RESULTS

		Input		Output, ac			Measured Output, ac		
Model	Sample No.	V	A	Phase-to-Phase, V	Total W	Pf	Rated V	KW	Power Factor
60 KWSA	1	-	-	480	60.0 KW	1	483	60.1	.97

The measured DC input current was 230 mA and was less than 0.5 percent of the rated inverter output current and the measured inrush current was 47 Amps peak at 480 Vac.

ANTI-ISLANDING TEST:

METHOD - PART A (Anti-Islanding Test per UL 1471 [IEEE P929])

While the inverter was connected to a simulated utility providing output power at nominal voltage and frequency at the point of common coupling (specified below), a parallel RLC resonant circuit was placed between the inverter and simulated utility. The quality factor of the resonant circuit was determined to be 2.5 or less (with the exception of operation at 125 percent) and the real load power was to be adjusted to place the inverter at 25%, 50%, 100% and 125% of the inverter's rated output.

The reactive load (either capacitive or inductive) was then adjusted to between 95% and 105% of the balanced condition in 1% steps. At each step, the inverter's trip time was measured on disconnect from the simulated utility.

RESULTS - PART A

Model:	60 KW (ECM/LCM)
Sample No.:	1
Rated Output:	480 V ac, 60 KW

1) 100% Output Power Condition

Real Power:	60.2 KW
VAR_C	147.7 KVAR
VAR_L	147.8 KVAR (Balanced load condition)

$$Q = \frac{\sqrt{VAR_C \times VAR_L}}{P_{REAL}} = 2.45$$

Simulated Utility Conditions at Point of Common Coupling:

V_{PCC} = 479 V ac (L - L), $Freq_{pcc}$ = 60.02 Hz

RESULTS (Cont'd.)

Anti-Islanding Test 100%

	% of Balanced Load	Actual Measured	Trip Time, mS
1.	0.95 VAR_L = 140.3	VAR_L = 140.2	105
2.	0.96 VAR_L = 141.8	VAR_L = 141.8	125
3.	0.97 VAR_L = 143.3	VAR_L = 143.2	115
4.	0.98 VAR_L = 144.7	VAR_L = 144.8	125
5.	0.99 VAR_L = 146.2	VAR_L = 146.3	120
6.	1.00 VAR_L = 147.7	VAR_L = 147.9	145
7.	1.01 VAR_L = 149.2	VAR_L = 149.1	119
8.	1.02 VAR_L = 150.7	VAR_L = 150.8	116
9.	1.03 VAR_L = 152.1	VAR_L = 152.4	102
10.	1.04 VAR_L = 153.6	VAR_L = 153.5	101
11.	1.05 VAR_L = 155.1	VAR_L = 155.2	101

RESULTS (Cont'd.)

2) 125% Output Power Condition

Real Power: 74.9 KW
VAR_C 192.1 KVAR
VAR_L 181.2 KVAR (Balanced load condition)

$$Q = \frac{\sqrt{VAR_C \times VAR_L}}{P_{REAL}} = 2.49$$

Simulated Utility Conditions at Point of Common Coupling:

V_{PCC} = 480 V ac (L - L), $Freq_{pcc}$ = 60.01 Hz

Anti-Islanding Test 125%

	% of Balanced Load	Actual Measured	Trip Time, mS
1.	0.95 VAR_L = 172.4	VAR_L = 172.6	114
2.	0.96 VAR_L = 174.3	VAR_L = 174.3	126
3.	0.97 VAR_L = 176.0	VAR_L = 176.1	154
4.	0.98 VAR_L = 177.8	VAR_L = 177.5	203
5.	0.99 VAR_L = 179.6	VAR_L = 179.8	294
6.	1.00 VAR_L = 182.4	VAR_L = 181.1	201
7.	1.01 VAR_L = 183.3	VAR_L = 183.1	120
8.	1.02 VAR_L = 185.1	VAR_L = 185.1	147
9.	1.03 VAR_L = 186.9	VAR_L = 186.2	196
10.	1.04 VAR_L = 188.7	VAR_L = 188.8	284
11.	1.05 VAR_L = 190.5	VAR_L = 190.3	335

RESULTS (Cont'd.)

3) 50% Output Power Condition

Real Power: 30.3 KW
VAR_C 73.3 KVAR
VAR_L 73.3 KVAR (Balanced load condition)

$$Q = \frac{\sqrt{VAR_C \times VAR_L}}{P_{REAL}} = 2.41$$

Simulated Utility Conditions at Point of Common Coupling:

V_{PCC} = 479 V ac (L - L), $Freq_{pcc}$ = 60.03 Hz

Anti-Islanding Test 50%

	% of Balanced Load	Actual Measured	Trip Time, mS
1.	0.95 VAR_L = 69.6	VAR_L = 69.6	105
2.	0.96 VAR_L = 70.4	VAR_L = 70.3	115
3.	0.97 VAR_L = 71.1	VAR_L = 71.1	120
4.	0.98 VAR_L = 71.8	VAR_L = 71.8	110
5.	0.99 VAR_L = 72.5	VAR_L = 72.6	110
6.	1.00 VAR_L = 73.3	VAR_L = 73.4	125
7.	1.01 VAR_L = 74.0	VAR_L = 74.0	145
8.	1.02 VAR_L = 74.8	VAR_L = 74.7	150
9.	1.03 VAR_L = 75.5	VAR_L = 75.5	345
10.	1.04 VAR_L = 76.2	VAR_L =76.3	205
11.	1.05 VAR_L = 76.9	VAR_L = 76.9	295

RESULTS (Cont'd.)

4) 25% Output Power Condition

Real Power:	15.1 KW
VAR_C	36.4 KVAR
VAR_L	36.4 KVAR (Balanced load condition)

$$Q = \frac{\sqrt{VAR_C \times VAR_L}}{P_{REAL}} = 2.41$$

Simulated Utility Conditions at Point of Common Coupling:

V_{PCC} = 475 V ac (L - L), $Freq_{pcc}$ = 60.01 Hz

Anti-Islanding Test 25%

	% of Balanced Load	Actual Measured	Trip Time, mS
1.	0.95 VAR_L = 34.6	VAR_L = 34.6	110
2.	0.96 VAR_L = 34.9	VAR_L = 34.9	105
3.	0.97 VAR_L = 35.3	VAR_L = 35.2	110
4.	0.98 VAR_L = 35.6	VAR_L = 35.6	115
5.	0.99 VAR_L = 36.0	VAR_L = 36.2	140
6.	1.00 VAR_L = 36.4	VAR_L = 36.4	105
7.	1.01 VAR_L = 36.7	VAR_L = 36.7	105
8.	1.02 VAR_L = 37.1	VAR_L = 37.1	145
9.	1.03 VAR_L = 37.5	VAR_L = 37.4	145
10.	1.04 VAR_L = 37.8	VAR_L = 37.8	160
11.	1.05 VAR_L = 38.2	VAR_L = 38.2	245

The inverter did not island as a result of conducting testing at 25, 50, 100, and 125 percent power output, while the inverter was connected to a resonant RLC circuit.

Note: Unit was verified to have a 5-minute delay during this test.

HARMONIC DISTORTION TEST:

METHOD

Samples of the power inverters indicated were subjected to this test. The power inverter was connected to the input source of supply. The output was connected to a simulated utility with an impedance of 2 percent of the inverter impedance (through a specified delta to wye transformer on the output of the inverter where specified in the installation instruction instructions). No transformer was used during the test.

The total harmonic current distortion and the maximum single harmonic current distortion were measured.

RESULTS

Model	Sample No.	Percent of Phase Output	Phase	Output A	Output V	Total Current Harmonic Distortion		Maximum Single Harmonic
60KWSA	1	See Below	A	68.5	480.8	0.75		0.25%
60KWSA	1	See Below	B	68.3	480.8	0.82		0.28%
60KWSA	1	See Below	C	68.6	480.8	0.78		0.33%

ODD HARMONICS
Number

	Phase A	Phase B	Phase C
Total THD	0.75%	0.82%	0.78%

		A	B	C
1 - 9	1	0.25	0.20	0.20
11 - 15	1	0.20	0.22	0.22
17 - 21	1	0.21	0.16	0.16
23 - 33	1	0.20	0.33	0.33
> 33	1	0.07	0.06	0.07

EVEN HARMONICS
Number

		A	B	C
2 - 10	1	0.19	0.24	0.24
12 - 16	1	0.05	0.07	0.07
18 - 22	1	0.04	0.03	0.03
24 - 34	1	0.03	0.02	0.03
> 36	1	0.03	0.02	0.03

The maximum total harmonic distortion was less than 5 percent of the fundamental at "full" load. The odd harmonics did not exceed the distortion limits. The even harmonics did not exceed the allowable distortion limits.

UTILITY VOLTAGE AND FREQUENCY VARIATION TEST:

METHOD

The inverter was connected to a simulated utility providing output power at nominal voltage and frequency at the point of common coupling as specified below. Waveforms as described below were initiated from the simulated utility and the inverter's response to each waveform was recorded and repeated for a total of ten times. The unit is provided with adjustable trip-set points and various settings were tested as outlined below for each waveform. Voltage waveforms initiated by the simulated utility were applied as shown below to individual phases, for three phase unit. The unit responded to each waveform and ceased to export power in the amount of time outlined under results for each waveform:

FAST UNDERVOLTAGE TEST

Waveform 1 (Condition A) - The inverter was operated within normal utility operating parameters of 480 Vrms, Wye, 60Hz, and was subjected to the following waveforms generated by the simulated utility. The waveforms detailed below correspond to the test results as outlined below. The unit ceased export of power within 0.1 second (100ms or 6 cycles) of reaching the test voltage generated by the simulated utility. The unit's trip settings were set at 6 volts prior to reaching the test voltage to insure tripping of the unit within the specified time limit. This test was repeated ten (10) times under the following waves.

A.- The simulated utility initiated a waveform at nominal voltage of 480 Vac, stepping it down in 1 cycle to 334 Vac. The waveform was held for 6 cycles and stepped up to initial voltage. The micro-turbine setting was 340 Vac with a time delay setting of 95ms. Results for this waveform are 1-3 under waveform 1.

B.- The simulated utility initiated a waveform at nominal voltage of 480 Vac, stepping it down in 1 cycle to 324 Vac. The waveform was held for 6 cycles and stepped up to initial voltage. The micro-turbine setting was 330 Vac with a time delay setting of 95ms. Results for this waveform are 4-6 under waveform 1.

C.- The simulated utility initiated a waveform at nominal voltage of 480 Vac, stepping it down in 1 cycle to 349 Vac. The waveform was held for 6 cycles and stepped up to initial voltage. The micro-turbine setting was 355 Vac with a time delay setting of 95ms. Results for this waveform are 7-10 under waveform 1.

UNDERVOLTAGE TEST

Waveform 2 (Condition B) - The inverter was operated within normal utility operating parameters of 480 Vrms, Wye, 60Hz, and was subjected to the following waveforms generated by the simulated utility. The waveforms detailed below correspond to the test results as outlined below. The unit ceased export of power within 2.0 seconds (2000ms or 120 cycles) of reaching the test voltage generated by the simulated utility. The unit's trip settings were set at 6 Volts prior to reaching the test voltage to insure tripping of the unit within the specified time limit. This test was repeated ten (10) times under the following waves.

A.- The simulated utility initiated a waveform at nominal voltage of 480 Vac, stepping it down in 1 cycle to 422 Vac. The waveform was held for 2 seconds and stepped up to initial voltage. The micro-turbine setting was 428 Vac with a time delay setting of 1.9seconds. Results for this waveform are 1-3 under waveform 2.

B.- The simulated utility initiated a waveform at nominal voltage of 480 Vac, stepping it down in 1 cycle to 416 Vac. The waveform was held for 2 seconds and stepped up to initial voltage. The micro-turbine setting was 422 Vac with a time delay setting of 1.9seconds. Results for this waveform are 4-6 under waveform 2.

C.- The simulated utility initiated a waveform at nominal voltage of 480 Vac, stepping it down in 1 cycle to 410 Vac. The waveform was held for 2 seconds and stepped up to initial voltage. The micro-turbine setting was 416 Vac with a time delay setting of 1.9ms. Results for this waveform are 7-10 under waveform 2.

OVERVOLTAGE TEST

Waveform 3 (Condition C) - The inverter was operated within normal utility operating parameters of 480 Vrms, Wye, 60Hz, and was subjected to the following waveforms generated by the simulated utility. The waveforms detailed below correspond to the test results as outlined below. The unit ceased export of power within 2.0 seconds (2000ms or 120 cycles) of reaching the test voltage generated by the simulated utility. The unit's trip settings were set at 8 Volts prior to reaching the test voltage to insure tripping of the unit within the specified time limit. This test was repeated ten (10) times under the following waves.

OVERVOLTAGE TEST (Continued)

A.- The simulated utility initiated a waveform at nominal voltage of 480 Vac, stepping it up in 1 cycle to 528 Vac. The waveform was held for 2 seconds and stepped down to initial voltage. The micro-turbine setting was 520Vac with a time delay setting of 1.9seconds. Results for this waveform are 1-3 under waveform 3.

B.- The simulated utility initiated a waveform at nominal voltage of 480 Vac, stepping it up in 1 cycle to 534 Vac. The waveform was held for 2 seconds and stepped down to initial voltage. The micro-turbine setting was 526 Vac with a time delay setting of 1.9seconds. Results for this waveform are 4-6 under waveform 3.

C.- The simulated utility initiated a waveform at nominal voltage of 480 Vac, stepping it up in 1 cycle to 532 Vac. The waveform was held for 2 seconds and stepped down to initial voltage. The micro-turbine setting was 524 Vac with a time delay setting of 1.9seconds. Results for this waveform are 7-9 under waveform 3.

D.- The simulated utility initiated a waveform at nominal voltage of 480 Vac, stepping it up in 1 cycle to 536 Vac. The waveform was held for 2 seconds and stepped down to initial voltage. The micro-turbine setting was 528 Vac with a time delay setting of 1.9seconds. Results for this waveform is 10 under waveform 3.

FASTOVERVOLTAGE TEST

Waveform 4 (Condition D) - The inverter was operated within normal utility operating parameters 480 Vrms, Wye, 60Hz, and was subjected to the following waveforms generated by the simulated utility. The waveforms are detailed below and correspond to the test results as outlined below. The unit ceased export of power in 2 cycles of reaching the test voltage generated by the simulated utility. The unit's trip settings were set at 6 Volts prior to reaching the test voltage to insure tripping of the unit within the specified time limit. This test was repeated ten (10) times under the following waves.

A.- The simulated utility initiated a waveform at nominal voltage of 480 Vac, stepping it up in 1 cycle to 537 Vac. The waveform was held for 2 cycles and stepped down to initial voltage. The micro-turbine setting was 531 Vac with a time delay setting of 30ms. Results for this waveform are 1-3 under waveform 4.

B.- The simulated utility initiated a waveform at nominal voltage of 480 Vac, stepping it up in 1 cycle to 540 Vac. The waveform was held for 2 cycles and stepped down to initial voltage. The micro-turbine setting was 534 Vac with a time delay setting of 30ms. Results for this waveform are 4-6 under waveform 4.

C.- The simulated utility initiated a waveform at nominal voltage of 480 Vac, stepping it up in 1 cycle to 539 Vac. The waveform was held for 2 cycles and stepped down to initial voltage. The micro-turbine setting was 533Vac with a time delay setting of 30ms. Results for this waveform are 7-10 under waveform 4.

OVERFREQUENCY TEST

Waveform 5 (Condition E) - The inverter was operated within normal utility operating parameters 480 Vrms, Wye, 60Hz, and was subjected to the following waveforms generated by the simulated utility. The waveforms are detailed below and correspond to the test results as outlined below. The unit ceased export of power in 0.1 seconds or 6 cycles of reaching the test frequency generated by the simulated utility. The unit's trip settings were set at 0.1Hz prior to reaching the test frequency to insure tripping of the unit within the specified time limit. This test was repeated ten (10) times under the following waves.

A.- The simulated utility initiated a waveform at 60Hz frequency and ramped it up to 60.4Hz in 2 seconds. Then stepped up in 1 cycle to 60.6Hz. The waveform was held for 6 cycles and stepped down to initial frequency. The micro-turbine setting was 60.5Hz with a time delay setting of 90ms. Results for this waveform are 1-3 under waveform 5.

B.- The simulated utility initiated a waveform at 60Hz frequency and ramped it up to 60.5Hz in 2 seconds. Then stepped it up in 1 cycle to 60.7Hz. The waveform was held for 6 cycles and stepped down to initial frequency. The micro-turbine setting was 60.6Hz with a time delay setting of 90ms. Results for this waveform are 4-6 under waveform 5.

C.- The simulated utility initiated a waveform at 60Hz frequency and ramped it up to 60.3Hz in 2 seconds. Then stepped it up in 1 cycle to 60.5Hz. The waveform was held for 6 cycles and stepped down to initial frequency. The micro-turbine setting was 60.4Hz with a time delay setting of 90ms. Results for this waveform are 7-9 under waveform 5.

D.- The simulated utility initiated a waveform at 60Hz frequency and ramped it up to 60.6Hz in 2 seconds. Then stepped it up in 1 cycle to 60.8Hz. The waveform was held for 6 cycles and stepped down to initial frequency. The micro-turbine setting was 60.7Hz with a time delay setting of 90ms. Results for this waveform is 10 under waveform 5.

UNDERFREQUENCY TEST

Waveform 6 (Condition F) - The inverter was operated within normal utility operating parameters 480 Vrms, Wye, 60Hz, and was subjected to the following waveforms generated by the simulated utility. The waveforms are detailed below and correspond to the test results as outlined below. The unit ceased export of power in 0.1 seconds or 6 cycles of reaching the test frequency generated by the simulated utility. The unit's trip settings were set at 0.1Hz prior to reaching the test frequency to insure tripping of the unit within the specified time limit. This test was repeated ten (10) times under the following waves.

A.- The simulated utility initiated a waveform at 60Hz frequency and ramped it down to 59.4Hz in 2 seconds. Then stepped it down in 1 cycle to 59.2Hz. The waveform was held for 6 cycles and stepped up to initial frequency. The micro-turbine setting was 59.3Hz with a time delay setting of 90ms. Results for this waveform are 1-3 under waveform 6.

B.- The simulated utility initiated a waveform at 60Hz frequency and ramped it down to 59.3Hz in 2 seconds. Then stepped it down in 1 cycle to 59.1Hz. The waveform was held for 6 cycles and stepped up to initial frequency. The micro-turbine setting was 59.2Hz with a time delay setting of 90ms. Results for this waveform are 4-6 under waveform 6.

C.- The simulated utility initiated a waveform at 60Hz frequency and ramped it down to 59.5Hz in 2 seconds. Then stepped it down in 1 cycle to 59.3Hz. The waveform was held for 6 cycles and stepped up to initial frequency. The micro-turbine setting was 59.4Hz with a time delay setting of 90ms. Results for this waveform are 7-9 under waveform 6.

RESULTS

Simulated Utility Conditions at Point of Common Coupling

V_{PCC}:	480 V ac
Inverter-Rated Output:	60KW
Inverter Output for Test:	2KW

Unit did cease to export power within the specified time.

Waveform 1 - FAST UNDERVOLTAGE TEST

	Time (or Cycles) to Disconnect	Faulted Phase	Reconnection Time
1.	94ms	A	≥ 5 Minutes
2.	88ms	B	≥ 5 Minutes
3.	98ms	C	≥ 5 Minutes
4.	94ms	A	≥ 5 Minutes
5.	89ms	B	≥ 5 Minutes
6.	98ms	C	≥ 5 Minutes
7.	94ms	A	≥ 5 Minutes
8.	89ms	B	≥ 5 Minutes
9.	99ms	C	≥ 5 Minutes
10.	99ms	C	≥ 5 Minutes

Waveform 2 - UNDERVOLTAGE TEST

	Time (or Cycles) To disconnect	Faulted Phase	Reconnection Time
1.	1900ms	A	> 5 Minutes
2.	1894ms	B	> 5 Minutes
3.	1889ms	C	> 5 Minutes
4.	1899ms	A	> 5 Minutes
5.	1894ms	B	> 5 Minutes
6.	1889ms	C	> 5 Minutes
7.	1900ms	A	> 5 Minutes
8.	1894ms	B	> 5 Minutes
9.	1905ms	C	> 5 Minutes
10.	1889ms	C	> 5 Minutes

Waveform 3 - OVERVOLTAGE TEST

	Time (or Cycles) To disconnect	Faulted Phase	Reconnection Time
1.	1900ms	A	> 5 Minutes
2.	1894ms	B	> 5 Minutes
3.	1888ms	C	> 5 Minutes
4.	1900ms	A	> 5 Minutes
5.	1894ms	B	> 5 Minutes
6.	1905ms	C	> 5 Minutes
7.	1899ms	A	> 5 Minutes
8.	1897ms	B	> 5 Minutes
9.	1890ms	C	> 5 Minutes
10.	1990ms	B	> 5 Minutes

Waveform 4 - FAST OVERVOLTAGE

	Time (or Cycles) to Disconnect	Faulted Phase	Reconnection Time
1.	< 2 cycle	A	> 5 Minutes
2.	< 2 cycle	B	> 5 Minutes
3.	< 2 cycle	C	> 5 Minutes
4.	< 2 cycle	A	> 5 Minutes
5.	2 cycles	B	> 5 Minutes
6.	< 2 cycle	C	> 5 Minutes
7.	< 2 cycle	A	> 5 Minutes
8.	< 2 cycle	B	> 5 Minutes
9.	2 cycles	C	> 5 Minutes
10.	2 cycles	C	> 5 Minutes

RESULTS (Cont'd.)

Waveform 5 - Over Frequency

	Time (or Cycles) To disconnect	Set Trip Frequency on unit	Power
1.	87ms	60.5Hz	0.5Kw
2.	87ms	60.5Hz	0.5Kw
3.	85ms	60.5Hz	0.5Kw
4.	74ms	60.6Hz	0.5Kw
5.	74ms	60.6Hz	0.5Kw
6.	74ms	60.6Hz	0.5Kw
7.	77ms	60.4Hz	0.5Kw
8.	75ms	60.4Hz	0.5Kw
9.	78ms	60.4Hz	0.5Kw
10.	83ms	60.7Hz	0.5Kw

Waveform 6 - Under Frequency

	Time (or Cycles) To disconnect	Set Trip Frequency on unit	Power
1.	83ms	59.3Hz	0.5Kw
2.	85ms	59.3Hz	0.5Kw
3.	85ms	59.3Hz	0.5Kw
4.	73ms	59.2Hz	0.5Kw
5.	73ms	59.2Hz	0.5Kw
6.	72ms	59.2Hz	0.5Kw
7.	77ms	59.4Hz	0.5Kw
8.	78ms	59.4Hz	0.5Kw
9.	78ms	59.4Hz	0.5Kw
10.	78ms	59.4Hz	0.5Kw

ABNORMAL TESTS:

GENERAL

Unless otherwise stated, conditions described below were applied during each of the abnormal tests described on the following pages.

A. Units provided with bottom openings were placed on a softwood surface covered with white tissue paper, and a single layer of cheesecloth was draped loosely over all ventilation openings. The cheesecloth was untreated cotton cloth running 14-15 yd/lb (28-30 m^2/kg) and having, for any square inch, a count of 32 threads in one direction and 28 threads in the other direction.

B. For units having supporting feet made of rubber or neoprene material, the feet were removed, unless the physical properties of the material were investigated.

C. The dead-metal parts of the enclosure were connected directly to ground.

D. Each test was conducted, until further change as a result of the test was not likely. If an automatic reset protector functioned, the test was continued for 7 hours. If a manual reset protector functioned, the test was continued for 10 cycles, except for a Listed molded-case circuit breaker which was continued for 3 cycles. The cycling rate for manual reset protectors was the minimum resetting time but not faster than 10 cycles/4 minutes.

E. The test was terminated, if any of the following conditions occurred:

   1. One or more components such as capacitors, diodes, resistors, solid-state devices, or the like opened or shorted,

   2. The intended branch circuit over-current protective device functioned, or

   3. An internal fuse or thermal cutoff opened.

OUTPUT SHORT-CIRCUIT ABNORMAL TEST:

METHOD

Samples of the power inverters indicated below were subjected to this test. The input circuits were connected to a simulated source of supply. The output circuits were connected to output leads 4 ft in total length which resulted in a short-circuit condition. The test was performed in Stand Alone mode.

The source of supply was fused in accordance to manufacturer's installation instructions.

The test was:

A. Continued for 7 hours, since an automatic reset protector was provided in the secondary output circuit (i.e. no additional protection was provided.)

B. Continued for 50 cycles of operation, since a manual reset protector was employed in the secondary output circuit.

C. Continued until the external protection (i.e. time delay fuse) opened. The test was conducted three (3) separate times.

The test was repeated four (4) times so the short occurred in different portions of the line cycle. Testing was conducted in Stand Alone Mode.

Output Line Voltage:	480 V
Inverter Loaded to:	60.1 W
Maximum Inverter Output Current:	70.1A

RESULTS

Model	Sample No.	Test Condition For Inverter L-L/L-N	Did External 3 A Ground Fuse in Input Circuit Open?	Remarks	Side of Output Transformer
60KWSA	1	L-L	No	No hazard.	N/A
60KWSA	1	L-N	-	No Hazard.	N/A

Note: The inverter was tested in Stand Alone Mode, however, upon applying the short as indicated above, it behaves like a current source.

There was no emission of flame or molten metal.